

# अथकालजिज्ञासा

(The Enquiry into Time)



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Kaal (**काल**) is the Sanskrit word for ‘Time’! As is the case with other Sanskrit words, the word ‘Kaal’ has a much wider meaning and applications than the word ‘Time’, it’s so called, English equivalent! From the very beginning of life on earth, ‘Kaal’ has engaged the attention of all the great scientific brains in the East, called sages, or ‘Rishis’. ‘Time’ has also been continuing to do much the same, in the West, for around three centuries or so. Science and Mathematics, on the other hand, are over five centuries old, in the East. There are several areas of discovery and inventions where-upon the East had reached centuries earlier than the West; facts regarding many of these are already in public domain, and others slowly, but surely, are coming out as well. However, they still carry the ‘stamp’ of West, so far! Time, or Kaal, is no exception! In this article, therefore, I shall use the word Time only, despite confusion associated with its usage, not Kaal, for ease of understanding!

I will start our discussion with a little Hindi poem, I read in the VI<sup>th</sup> standard and, in my view, it is still one of the best Hindi poems on ‘time’; titled : **फिर क्या होगा उसके बाद?** (Phir Kya Hoga Uske Baad?) : literal translation - Then, what will happen after that???

This is a conversation between a mother and her inquisitive little child. The child keeps asking his mother repeatedly : ‘*Phir Kya Hoga Uske Baad*’; and every time the adoring mother keeps giving some pleasing answer or the other... e.g. *Then you will grow big... Then you will get married... Will have kids of your own; etc. etc.* Slowly, however, she gets tired of finding any more answers, while the child untiringly keeps repeating the same question, after listening to her answer to his earlier question. Eventually the mother says : “*After that I will become old and die!*”

This comes as a shock to the child, his eyes swell up for a moment; he obviously has some idea what death means! However, wiping the tears the very next moment, he repeats the same question : ‘*Phir Kya Hoga Uske Baad?*’ Obviously the mother is lost for words! What was there to say anyway, once she is dead!!!

At this point the poet comes in... Apparently impressed by the child’s demeanor, who has remained relatively unperturbed by mother’s pleasant, as well as, not-very-pleasant answers! *Happiness and unhappiness is just “Maya” of life...* He says and then he closes the poem with the next statement : “*what will happen uske baad’, is a question of infinite complexity*”! Both profound observations, though neither made any sense to me then!

Let us commence our journey, with the 2<sup>nd</sup> observation first, for; as we will see, Maya we are already in! Much as we try, it’s not easy, if not impossible, to get free of Maya. We shall see, nevertheless, as we proceed!

As we can make out by now, ‘*what will happen uske baad*’ is not an expression of mere childish inquisitiveness. Since the very beginning, we all, irrespective of our ages and/or backgrounds, have been concerned with the same question, again and again : “*What will happen after that!*” It is in fact an enquiry into, what we have given the name : **‘Future’**. It is defined as an inexhaustible reservoir of “moments” from where, the moments appear to continuously flow towards us, one moment, every moment. This moment stays with us for just one moment; this we call the **Present**. After that it seemingly moves away to another reservoir of moments, to which we have given the name **Past!**

The experience of this incessant ‘movement’ of moments, from future to present to past, is what we have given the name : **Time**. And since this flow of moments appears to travel in one direction only, from Future to Present to Past, we have given it the name : **‘Time’s arrow’**.

In our normal experience this arrow of time does seem to keep ‘moving’, from future to present to past, while the experiencer keeps getting older & older, till one day he/she dies! Like what the mother says in the poem! But the arrow does not apparently, stop there... It keeps on moving even thereafter, for others to experience it, so to say, till they too die off, one by one! And this goes on and on... That’s the reason, the concept of time is also ‘linked’ to death in our minds; a person is born with a personal ‘quota’ of time, it is believed; and once that quota gets over, he/she dies! Time, therefore, is considered to be the **Death** itself, in some cultures; in fact, one meaning of the word Kaal, is death too. We are worried about the future because we know our death lies in the domain of future! And no one wants to die!!!

Why this entity, we call Time, has kept all thinking minds engaged as ‘illusive’, as I said in the opening few words, is, as we shall see, that we, in a way, have

tied ourselves in knots! The difficulty in trying to explain this is that it's actually impossible to convey the universe as an '*'ever-changing now'*', in language, because it is actually language itself, experienced as thought, that creates the illusion of time. However, those who are able to silence the thought process, like the Rishis, through practices like meditation, have directly experienced the reality of timelessness. And it is not impossible for others, to at least, conceive this intellectually!

In this context it may also be noted that the ‘direction’ of motion of this so called Arrow of Time, doesn't have to be 'backwards' only – going from future to present to past only; it can also be considered going ‘forward’ – into future from present and past. This is just the glimpse of the mystery that “motion” is capable of causing! We shall elaborate more of this later. Here I just want to mention of **Zeno**, the Greek philosopher, whose name one will find in any write up on Time & its Motion. Not many may know about his Indian contemporary, **Rishi Kanada** (ऋषि कणाद), who explicitly mentioned of Motion as the cause of all phenomena in the world in his **Vaiśeṣika Sūtra** (Sanskrit: वैशेषिक सूत्र). Word Vaiśeṣika is derived from Viśeṣa, (विशेष), meaning "particularity", (similar to the “special” theory of relativity), that is to be contrasted from "universality", (i.e. the “general” theory of relativity)! We shall meet more of this great Rishi, in our subsequent discussion!

Back to what we were talking about... since we are considering Time as a river of moments, we have been able to ‘notice’ this motion of moments, only because we are standing stationary on the river beach. What if we are not stationary? If we are ourselves moving, say at a considerable speed, like on an aircraft? What happens to the water of the ‘rivers’ below? It appears to be frozen! In other words, no more movement of moments! No more Time, no more Time’s arrow!!!

Einstein's Special Relativity Theory, says more or less the same thing : If we move @ the speed of light (in vacuum), Time will stop, it says. Einstein assumes that nothing can move faster than light (in vacuum)! If we move at smaller speeds, Time will not stop completely, but will move at speeds slower than its normal speed! In other words, it will appear to have *dilated* on account of external motion. We will spend more time with Einstein as well as motion, later!

If we notice, we are into all sorts of motions, all around us! Our ancestors, the Rishis in particular, knew that everything in the world, is in motion. That's how they named the world "**Jagat**"; which in Sanskrit, means : *That which is always on the 'move'!* They were the first to discover that earth rotates on its axis. Now, in any case, we know that not only the earth but other planets also rotate on their respective axes, and the whole lot of them, keep moving round the sun! The entire Jagat is indeed, in continuous motion : The moon going round the earth! Earth going round the sun; sun going round the Milky Way galaxy; Milky Way going round other galaxies; and so on and so forth! In this ever-changing 'divine play', the unceasing movement or 'dance' of the universe in which every constituent has its own motion; it is impossible to even conceive the overall situation, let alone calculate anything. That's why, to predict 'what will happen in the next moment', certainly does appear to be a 'problem of infinite complexity', as the poet rightly observed!

Fortunately, the astronomers have succeeded in estimating the velocities of many component systems of 'Jagat'. Velocities of Earth about itself and around the Sun and the other planets within the solar system, for instance, have been calculated fairly accurately! If we consider the Earth and the entire planetary system around the sun as a single body, despite multiple internal movements, this 'body' would appear to be going ahead, in one direction, with a resultant single speed. Rishis have given the name **Leela** to this motion of Jagat; a name that is given to the game that little children play! There is only joy in their game! No winning, no loosing! This is exactly what is meant with the word

Leela! All this celestial movement is said to be God's Leela, the Divine Play! As we noted, Leela is a game that is played simply for joy... God playing with us just for fun, so to say!

Conceive this situation for a moment : There is infinite space which contains various material bodies in it, including all the non-living as well as living beings like us. All of this is in continuous motion along with the planet, we live on, as part of Leela, the divine march of our universe...

There are a few scientists who do not agree that space is infinite. We might have tried to confine Infinity into some sort of definition, but not many really understand infinity! Indian sages gave the name Bramhan to our Creator God, God with capital 'G'! This God is Real; so whatever He has created is also Real. We call them all gods, with little 'g'! And there is nothing that He has not created; that's how Hinduism is said to have 30 million gods! Including us humans! So we all are little 'gods' too! The Veda declares : अहं ब्रह्माऽस्मि, (*Aham Brahmasmi*), meaning *I am God!!!*

**Bramhan**, the name, is just in the manner of expression; He is supposed to be 'name-less' otherwise! On the other hand, all the names in the world, are His, i.e. He has infinite names! In Sanskrit the word Bramhan means : *that which keeps growing bigger and bigger*. This more or less matches with our so called definition of Infinity. I would like not to dwell into this discussion any more except mentioning the story of Georg Cantor, the Danish mathematician who tried to go deep into infinities. He became a mental wreck and died prematurely at a mental clinic in Germany! This is not to mean certainly though, that any one discussing infinity will meet Cantor's fate, but why take risk???

Coming back to our mental picture, perched on our planet and speeding away at a high speed, we will notice leaving behind a frozen river of moments, as

discussed earlier! This is our Time, emergent phenomena of Divine play, the Leela! This, by the way, is not the Time or Kaal that we link with death. In other words, this particular time that we have noted to be an emergent phenomenon of Leela, can't be blamed for 'doing' things on earth; neither good things nor bad things! Things happen due to Leela, itself, the continuous celestial motion! There is nothing else, other than God's Leela! Everyone and everything is caused by His Leela only! There is no other doer; including Time! In Buddha's words : *Events happen, things are done, but there is no individual doer there-of!!!*

Note, the Time, caused as Emergent phenomenon of God' Leela, has no arrow; it just is! We may call it Eternal Time which is beyond time of our usual understanding, and is associated with everlasting life, salvation, and a lasting fellowship with God. Eternal things have infinite duration and are characterized by a never-ending present.

People express the experience of change in terms of time as a linguistic means. Time, as we just noted, is an abstract dimension on which the human mind projects its experience of the changing reality. Change is intrinsic to physical reality. The passage of time and our passage in time are metaphorical expressions of the fact that everything changes.

Therefore, it is only as a result of God's Leela that we are born... we grow and we die... Nothing to do with Time! Sage Bharthari says in Vairagya Shatakam : कालो न यातो वयमेव याताः meaning *Time is not the one that's passing, it is we only who pass away...* This is what he is referring to : The Eternal face of Time!

It is quite clear from the above that the so called 'movement' of time is not the proverbial 'Moving Finger' that writes our destinies, instead, it is the movement of earth and the planets of the solar system, as part of God's Leela! This is

exactly the concept of **Astrology**, a broad field concerned with the search for meaning and predictive information in the sky. The Astrologer prepares the Horoscope of the person, in accordance with the position of Sun, Moon and the other planet, at the time of his/her birth, to predict what will happen and when, in his/her life.

There are two parts to this whole process, calculating the exact positions of planets, and, predicting the ‘effect’ of each planet, in those particular positions. We need not go into details except admiring the fact how astrologers could conceive of such an ingenious concept. The initial astrologers must have collected the whole lot of statistical data through personal research, throughout their lives; and/or through meditation etc. particularly to work out the ‘prediction’ part. How accurate they were then, is difficult to say. Today we don’t have such truth-seekers any way, only money-seekers, thereby bringing the Science (Art?) to disgrace and defame!

The first part of Astrology, concerning the position of planets, is linked with Astronomy! It is unfortunate, however, that Astronomers do not regard Astrology as Science, though despite the differing beliefs surrounding its relative scientific merits, Astrology has always been closely linked with Astronomy, with both fields taking on significant developments in our lives.

Astrology is called **Jyotish** in Sanskrit. Astronomer, **Maharishi Lagadha** of India, is credited with creating systematic format for Date calculations. He has also composed **Vedang Jyotish**, probably the oldest scripture of Mathematical Astrology, it being a part of Rig Veda, the oldest acknowledged scripture in the world. That notwithstanding, written History teaches that Indians learnt the ‘skill’ of Astrology, from Greeks!!!

Be that as it may, is there some other time then that we meet in science? Not really! Note that it is challenging to describe time without using our ‘time-based language’! Unfortunately, in English language, we have ‘overused’ the word ‘time’! Our history, for instance, uses terms like timekeeping, period time, before time, and time after time etc. We relate time into dimensions, and space-time, besides past, present and future. It is therefore difficult to unveil the “real-time” because we use the word ‘time’ in hundreds of different ways. God only know what would have been the case, were there no words for time (and dates) in our vocabulary! It is believed that to be apparently the case in respect of some primitive tribes of Brazil... Must be interesting!!!

Anyway, let us come to what the Physicists understand by Time!

Time in physics is defined by its “measurement” : time is what a clock measures. In classical, non-relativistic physics, this Time is a scalar quantity and, like length, mass, and charge, is usually described as a fundamental quantity. It can be combined mathematically with other physical quantities to derive other concepts such as motion, kinetic energy and time-dependent fields.

But that’s the point! Time is not an object that can be directly measured! What Physics ‘measures’ is the Clock Time which is ‘calculated’... If a body covers a distance ‘d’ with velocity ‘v’, then it is said to have taken “time” that is equivalent to  $= v/d$  units. This Time therefore, is the first derivative of Motion! Let us call it “Temporal Time” which is associated with change, instability, and what passes away. Temporal things are limited by time and have a limited existence. For example, people grow up, grow old, and die. When we say “Time”, this is the Time we are referring to!

And though the hands of a clock ‘flow’, time itself does not. Time is a concept introduced specially to describe the flow of events around us; it does not itself

flow, it describes flow. Clocks do not measure time per se but they measure movements, for; clocks do not ‘know’ time; only a conscious mind can know time! In fact, we use the ‘noun’ time as a ‘verb’ for action and activity so that even scientists assume that time is needed ‘before’ something can move. The universe, however, doesn't ‘use’ time to move. We do not measure the passing of time: we measure our own passing, as great Bharthari has said centuries ago!

It is therefore wrong to start from the position that events take place "in time" and that change "needs time" to take place. Change is intrinsic to physical reality, in the form of Leela! It is the “measurement” that makes Time, illusive! We shall talk more about it when we discuss Maya!

In scientific language, Gravity is said to be the cause behind all the celestial motion, what we have been referring to as Leela. Whether that is true or not, Gravity is another, so called, mysterious phenomenon, just as time is! And both are related to motion! Time, as we noted, is the first derivative of motion; whereas gravity is just the result of our surroundings accelerating relative to us! Being related to acceleration, it is the second derivative of motion!

Time cannot be reversed, only motion can be, or more precisely, only velocities of objects! Also, time has no arrow, only motion has! Finally, it is not the flow of time that we are unable to stop, but the motion of celestial objects.

So, it is the Motion per se, that is behind all the mystery around! Not poor Time!!!

Any way; let us look now how time is “measured”! As we saw, time is not an object that can be directly measured! What clocks ‘measure’ is the ‘calculated’ or “Clock Time”! Clocks consist of an object that repeats the same motion over and over again, an oscillator, with a precisely constant time interval between

each repetition, or 'beat'. Attached to the oscillator is a controller device, which sustains the oscillator's motion by replacing the energy it loses to friction, and converts its oscillations into a series of pulses. The pulses are then counted by some type of counter, and the number of counts is converted into convenient units, usually seconds, minutes, hours, etc. Finally, some kind of indicator displays the result in human readable form.

Once this is understood, many misconceptions about time get resolved automatically! A clock projects the earth's motion in the form of numbers, and we use some thinking to convert the numbers into time. Thus to know the time or the "duration" of time, one needs to do some thinking/calculations, and that's how time as a concept, lives in our minds. Thus Time per se, is not an 'illusion', and/or 'unreal' as some people think; it very much 'exists', though not in the way it is perceived! Temporal Time and Eternal Time are not different, but the two faces of one single entity : **Time!!!**

For the present, let us understand how the word Time, first came into existence! Right from the ancient times the motion of the Sun across the sky has been related-to "time". The sunlit Half was called the day, and the dark half, the night! This unit "day", we only incorporated as a '**measure**' of time & divided it into 24 equal intervals called "hours"! The Earth spins on its axis, and one revolution is called one day (plus night), from where we get hours, minutes and seconds. The 'second' is the conventional unit of time! One revolution of earth around the sun, and we have our 'year'!

Clock-time exists in our minds as numbers on the clocks, and we have been taught how to convert those numbers into time. When clocks didn't exist, where could the ancient man get this essential information for day to day living? Well, he looked at the position of the Sun and guessed the time of day. This practice of using the position of celestial objects, such as the sun, moon, and stars, to tell time has been used for thousands of years and is still used by

some cultures, even today. A sundial for instance, the ancient most device to ‘measure’ the motion of our planet, gives the local time, altitude, and the declination of the sun, stars, and planets during one day. World’s biggest sundials exist in India as parts of Jantar Mantar, at Jaipur, Delhi and Ujjain. Each is over 300 years old.

Other than the Sundials, our ancestors also used various innovative methods over time, to know local time, such as Water clocks, Hourglasses, etc. etc. besides of-course, mechanical/electronic watches. But one should not lose the sight of the fact that none of these equipment directly ‘measure’ time; for, Time isn't a force causing motion, it being only a mathematical quantity of change that we ‘calculate’ using the clocks.

Let us now have a quick look at the Western view of Time!

The contemporary Western Philosophy, contemplates two main ‘theories’ of time, (though it must be stated that these are not the only views on the nature of time) : Presentism and Eternalism... **Presentism** is basically the view that only the present moment (or “now”) exists, or is active. That moment is where we perceive things happening, or becoming, and it separates a known past from an unknown future. It appears to change or progress, leading to the notion of dynamical change. This view largely corresponds to the West's general perception of time. **Eternalism**, on the other hand, is the view that all time is equally real and co-exists. There is no present moment singled out, and hence no temporal flow, and no difference between past and future. This is the view in mathematical physics where there is no intrinsic present moment.

Between both these two views of time, yielding paradoxes and inconsistencies, it is generally believed that time is not Real!!!

Time as a subject in Physics, is also surrounded by controversies. Galileo Galilei is quoted to have said : “*Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed*”. So far it is very sensible! But his next sentence is game changer : “*It is written in the language of mathematics*”, he said! His followers, are therefore, more of mathematicians these days, than physicists! They have made the subject so complicated that even the most accomplished mathematicians get confused!

Sir Isaac Newton, considered to be the ‘Father of Modern Physics’, defined time to be ‘absolute’ that ‘flows’ uniformly without reference to anything external. Newton was arguing that, even if our clocks might be imperfect, real time flows at a steady rate, serving as a kind of master clock for the universe. Newton’s definition meshes with our commonsense impression of time — that it passes at the same rate for everyone.

This means that time exists independently of any perceiver and progresses at a consistent pace throughout the universe. Newton believed that time (and space), are completely unrelated to the motion of objects and exist independently, simply as a "container" through which objects move. His ideas were fundamental to the development of Newtonian Mechanics, which is based on his famous Three Laws of Motion, that we all have been taught. I may well mention in the passing that Newton’s said laws of motion, as well as his ‘discovery’ of the phenomena of gravitation, are all contained in the *Sutras* (verses), of **Vaisheshika** School of Indian philosophy, composed by Rishi Kanada (ऋषि कणाद), over 1500 years before Newton! Remember, I had mentioned the name of this great Rishi, earlier?

Not only that, a good 500 years before Newton, Indian mathematician, **Bhaskara-II**, developed an understanding of calculus, the number systems, and solving equations, which were not to be conceived anywhere else in the world till several centuries after him. His masterpiece, the **Siddhanta Siromani** (meaning : *Crown of Treatises*), which he wrote at the age of 36, comprises of four segments : **Lilavati** : A treatise on arithmetic, geometry and the solution of indeterminate equations; **Bijaganita** : ( A treatise on Algebra); **Goladhyaya** : (Mathematics of Spheres); and **Grahaganita**: (Mathematics of the Planets).

All this knowledge was ported to the west, by Arabian sailors, over time!!!

I would just like to add a few words on Lilavati, composed in verse form, like all other ancient Sanskrit scriptures, so that pupils could memorize the rules without the need to refer to written text. Some of the problems in Lilavati are addressed to a young maiden of that same name which leads one to the speculation that Lilavati was the name of his daughter! That may or may not be true, but can it be just a coincidence that the word rhymes with Leela, we have met earlier?

Coming back to Physics, it was Albert Einstein, acknowledged as the greatest scientist in contemporary history of Science, who made the revolutionary suggestion that time was not Absolute; it was ‘Relative’ to the speed of the observer... Einstein showed that there can be no “master clock” for the universe, as Newton had imagined. Instead, measurements of time depend on the motion of each observer. An exception is the speed of light, which is seen to have the same value by everyone (about 300,000 km per second, in vacuum). The theory also implies that the speed of light (in vacuum), is the ultimate speed limit for the universe.

Thus, if each observer carries his own personal clock, his clock will show time depending upon his speed. This gives rise to all sorts of interesting phenomena, such as the “Twin Paradox”. If one of the twins moves away at very high speed, and the other stays put, the one who had gone away, will age much lesser than the other! Whereas the stay-at-home twin’s progress through space-time is wholly through time, the traveling twin’s progress is partly through space, so that his progress through time is less than that of the stay-at-home twin (thence he ages less). There can be complications in this, for instance, the ‘travel’ in all probability, will not be simple uniform motion; there will be acceleration/deceleration involved while starting/return. Also how human body reacts to such motions, is also to be taken in account! Etc.

In some sense anyway, time was always ‘felt’ to be ‘relative’, for instance when one is in a happy state of mind, time appears to move faster; on the contrary if one is sad, time appears to move slowly. Etc. The Special Relativity Theory however, proves mathematically and shows that time, indeed, ‘dilates’. This is based on the axiom that nothing can move faster than light in vacuum; therefore, if an observer moves with speed equal to speed of light, his clock will show no time! Time will stop. As the luck would have it, it is not possible for anyone to move at the speed of light; this is one phenomenon therefore, that has remained un-observed!!!

Einstein derived the equation  $E = Mc^2$  arguably the most famous equation of twentieth century physics that combines the two statements concerning the conservation of mass and conservation of energy. It says that mass and energy are two forms of one and the same thing, and that one can be converted into the other! He also ‘combined’ time with space, as its fourth dimension and called it the four dimensional “Space Time Continuum”. He described the space-time to be the basic fabric of the universe on which material bodies ‘move’. This fabric gets ‘curved’ around the body depending upon the size of the body; larger the body, greater the curve! The equations of his General Theory of Relativity relate this ‘space time curvature’ to “Gravity”! Thus, just

as the presence of mass/energy determines the geometry of space, the geometry of space determines the motion of mass/energy!

So, we are back to Motion, the main ‘culprit’ in this entire story, as first pointed out by Rishi Kanada, noted earlier! Acharya **Gaudapada**, Guru of Shankaracharya’s Guru, gives an interesting example of the motion of Firebrand, burning wooden stick or torch, with fire at its one end. What happens when someone rotates the firebrand around himself, in dark? Well, it gives all sorts of appearances, depending upon the type of motion, including that of the appearance of a complete lighted circle, (**Alāta chakra**, a typical example used by the Buddhist school, known as **Vijñānavāda**, according to which, our mind or consciousness, conjures up the external world which has no reality of its own). The external world appears to be real the way circle of fire appears to be! Gauḍapāda has used the simile of ‘fire-circle’ in order to explain Consciousness : Just as the fire-brand when not in motion is free from all appearances, he said, the consciousness too when completely ‘still’, remains in its true intrinsic nature. The external objects, in other words, are not born of Consciousness; nor is Consciousness born of external objects... The only way to keep the consciousness ‘still’, teaches the Indian philosophy, is Meditation; a different subject altogether!!!

Consciousness is too complicated a subject, to be understood by people like us, unless we have ‘stilled’ it; our mind or consciousness.

What happens when this consciousness is absent, presumably; like in dreams? Well, that’s another field, and is based on speculations, by and large! It is believed that people go through dreams on account of their unbridled sense of desiring. Most human dreams belong to the category of unfulfilled desires getting fulfilled in dreams!

Be that as it may, the ‘rules’ that time (and space) follow in dreams are totally different than they do, in waking life; quite like the quantum world versus the normal world! In dreams, for example, the space generally gets warped and time may sometimes appear to go very slow and sometimes even the time of several years may get ‘covered’ in just few minutes!

To a stilled mind, there is no motion! Just Timelessness, as we have noted earlier. But there is also what we call, ‘Memory’, where we are said to store all that happens in time. This generally means ‘Past’, as we know. One can only speculate about ‘Future’, in the form of Astrological predictions etc. Memories of both, are said to ruin our ‘Now’!!!

Anyway, let us not get stuck into all these philosophical complications; instead we go back to our earlier observation that it is not time (or gravity), but the underlying ‘motion’ (or ‘Leela’) that is the cause of all the mysteries in the world. Consider the simple case of a flying airplane. If I am in it, the airplane is not moving for me; if I am on the ground, the airplane is moving; if I am in space, both the ground and airplane are moving!!!

Going back to Rishi Kanada for a moment, who, as I mentioned earlier, was the first to explicitly state that “motion” is the cause of all phenomena in the world. Rishi Kanada, is also to be remembered for giving us the words “Anu” and “Parmanu”; Atoms and Molecules! He defined life as an organized form of atoms and molecules and death as an unorganized form of those. His perception about the atom was different from the similar concept of the more well known, ancient Greek philosophers, Leucippus, Democritus etc. While Kanada recommends that atoms as buildings blocks differ both qualitatively and quantitatively; the Greeks, theorized that the atoms differed only quantitatively but not qualitatively. In any case, Kanad had conceived and described the atomic theory, much before Dalton, the much celebrated ‘Father of Atomic Theory’!!!

Subsequent physicists were able to show that atoms were not indestructible as these earlier scientists and philosophers had thought. This led to the quantum world of very small particles of matter moving at very high velocities, following very different ‘rules’ than that of conventional physics, of larger bodies moving at relatively lower speeds. Here the big problem that the researchers faced was to how to investigate a phenomenon which gets changed just by it being observed! If, for example, the position of a particle is observed with precision, its ‘momentum’, (which is related to speed), cannot be calculated with similar precision and vice versa. This is the well-known “**Uncertainty Principle**” for which **Heisenberg** was awarded the Nobel Prize! Later developments in the fields of Fractals and the Chaos theory, have resulted in more Nobels!!!

Perhaps the most non-intuitive aspect in the quantum physics is the ‘entanglement’ of two particles, such that they seem to interact (instantaneously) even when physically separated at far distances from one another (Non-locality). Many experiments have since been conducted that verify this. Quantum entanglement shows that we are non-separable parts of a universe that is one entity and that the desired state is, to immerse ourselves into that entity, according to the Eastern mystics! Quantum physics has thus brought physics closer to philosophy – role of consciousness in measurements!

Both the general theory of relativity, and the Standard Model of particle physics are time-symmetric — that is, the physics they describe is the same, regardless of whether the variable called “time” increases or decreases. Moreover, they say nothing at all about the point we call “now” — a special moment (or so it appears) for us, but seemingly undefined when we talk about the universe at large. The resulting timeless cosmos is sometimes called a “block universe” — a static block of space-time in which any flow of time, or passage through it, must presumably be a mental construct or other illusion. This is another widely debated subject between physicists!

An important argument in favor of the directionality of time, is the second law of thermodynamics. The law states, roughly, that in a closed system, entropy (the amount of disorder) must always increase. The fact that things get more disordered — but never the other way around — appears to support the Time's Arrow! The argument is that once you have broken the egg and turned it into scrambled eggs, you can never get the original egg back from it. Counter argument to that is that the reason you can never get the original egg from scrambled eggs is because the scrambled eggs are the result of the egg being destroyed. That's not an issue of entropy. It's causality. And like most causal events, they can't be undone.

In philosophy, the concept of Causality refers to a ‘cause’ that takes place first, which then gives rise to ‘effect(s)’, which then act as causes for further effects and so on. This is how the world is supposed to take shape. In this concept, the God is called “**The First Cause**”!

Another argument against Entropy, is if time doesn't flow forward, as we have seen, why should it be expected to ever flow backward?! Instead, time's job, purpose and reason for existence, is to allow for events to unfold on all levels of space, which bring us to the undeniable fact that time is fundamental. Space is where things are. Time is what allows them to move. Without time, there would be nothing!!!

Perhaps the most important argument against increasing ‘disorder’ is the existence of increasingly ‘ordered’, “Intelligent Life”!!!

According to Astronomy, the farther a galaxy is from Earth, the faster it is speeding away from us. This discovery has paved the way for what we now call

the **Big Bang** model of cosmology — the idea that all of the matter and energy we see around us was once concentrated in a much smaller space. The implication is that the universe — and possibly time itself — had a beginning. Whether the Big Bang should be considered the beginning of time continues to be debated. Some cosmologists suggest that the universe runs through cycles of expansion and contraction. While this itself is debated between physicists, this cyclic movement is different from Indian concept of Time Cycles.

In Indian worldview, time is not ‘seen’ as solely linear, but both linear and cyclic. The circular time is the one in which everything manifests from the unmanifest and goes back into the partially un-manifest part; to manifest again. Beyond the manifest and partially un-manifest lies that Reality, the eternal un-manifest, Brahman; every Hindu’s final destination! It is to be understood like this : our body is the ‘manifest’ part with partially un-manifest, ‘mind or consciousness’, inside each body. When we die, the body is left behind but the mind goes on its onward journey, like a ‘seed’. From this seed new bodies and new seeds are born, and the cycle goes on. But beyond these two, each one of us has the Atma (आत्मा) or soul, which is nothing but the eternal un-manifest, Brahman or Paramatma, (परमात्मा).

I am tempted to deviate a little from the subject and present the above Vedantic concept in a beautiful mathematical expression like this :

$$\text{आत्मा} = \text{परमात्मा}$$

To me, this is no less beautiful than  $E = M.c^2$

Anyway, in Vedanta, there are two separate Hindu doctrines pertaining to the continuity of Consciousness after Death. The first is Reincarnation, to which every person is subject. The second is Eternal Life, known in Sanskrit as Moksha, or Liberation, available to few! Let us leave it at that!

History is a description in linear time, so the West has laid more emphasis on writing history, not necessarily ‘what happened’; but what they thought ‘should have happened’! The Indian sages, on the other hand, wrote Puranas, meaning : that which always comes back! ‘Dates’ are not important in that! The ‘Contents’ are enough! It is not surprising therefore that Valmiki could write Ramayana even before Lord Ram was born! The West claim that the Christ was the ‘first historical person’; they are right because he was born only once! Our Ram, Krishna and so on are not historical; they are Pauranic and therefore keep on ‘coming, going and coming’ again and again! It is like the seasons : we know after winters, comes summer, then rains, and back to winters; the only thing is that every time the ‘history’ that takes place along with each, is different!!!

In Indian philosophy, the universe went through repeated cycles of creation, destruction, and rebirth. This led to viewing time as a cycle, the so-called “wheel of time” or **Kalachakra**, in which there are repeating ages over the infinite life of the universe. Unlike the Western view where by Time is supposed to have a ‘beginning’, Hindu thought sees the universe and time as having been going on beginninglessly, (**Anadi**). However, within this beginninglessness, there are cycles of creation usually thought of in terms of the seed-plant metaphor, highlighted earlier!

Each cycle of creation begins from a seed which sprouts, grows, flowers, withers, and dies, but leaves behind (from the flower or the fruit) a seed from which the next cycle of creation will arise. As time passes, the Dharma or righteousness of the first half of the cycle is used up so that, by the last half, injury, greed, hatred, delusion, disease, and old age arise due to the deterioration of Dharma. These cycles, the four Maha Yugas, contain mind boggling periods of Time : First and the biggest, Satya or **Krit Yuga** consists of 1,728,000 years, followed by **Treta Yuga**, 1,296,000 years, **Dvapar Yuga**, 864,000 and the last and the current Maha Yuga, the **Kaliyuga**, 432,000 years!

Each yuga is one-fourth (25%) shorter than the previous one. As time moves from one yuga to another, human society is thought to degrade in moral, spiritual, and other qualities.

**Dharma** is a word without direct translation. It stands for "to hold," "to support," or "to maintain". Though in English it is translated as "religion" or "duty". It is in fact one of the four **Puruṣārthas** : "object of human pursuit" or "human endeavor" in Sanskrit. The other three being : **Artha** or Acquisition of wealth; **Kama** or Gratification of desires; and **Moksha** or Attainment of spiritual liberation, introduced earlier!

According to Puranic accounts Kaliyuga began in 3102 BCE, marking the end of Dvapar Yuga, after the death of Lord Krishna. Thus Kaliyuga is 5125 years old, as of 2024 and will end in 428,899 CE!!!

These figures apply to our current Universe only! And there are countless such Universes! Something like the Multiverse Theory of current Physics!

Not only that, Hinduism uses a complex system of time measurement to measure time at various scales, from the blinking of an eye to cosmic eras. **Trasarenu**, for instance, is the smallest unit of time, equal to 1/1687.5th of a second. And there are literally hundreds of intermediate units going up to the highest conceived by any other civilization! For instance, **Kalpa** is equal to 4.32 billion years, or one thousand Mahayugas. It is also known as one "day of Bramha"; (not Brahman). And Manvantara, a period of time that lasts 306,720,000 years. Each Manvantara repeats 71 Yuga Cycles. Etc. Etc.

With that I think we are in the right frame of mind, to take Maya head-on! Einstein had once written : *For us believing physicists, the division between past,*

*present and future has only the significance of a stubbornly persistent illusion.* An ‘illusion’ is understandable; but what is a stubbornly persistent illusion? That comes very close to what our sages called **Maya**! The concept of Maya, generally used, usually incorrectly, to denote illusion, or delusion, or some such thing; but the theory of Maya forms one of the pillars upon which the Vedanta rests; it is, therefore, necessary that it is properly understood.

**Maya** first appeared as the ‘magic weapon’ of **Indra**, in Rig Veda. Indra, as we know, is the main god, or the king of gods, in Rig Veda; the concept of Trinity, Bramha, Vishnu and Shiva, as gods, appeared later, in Pauranic period. Indra used Maya to confuse his enemies. Hence Maya became associated with magic, confusion, etc. One of the meaning of "maya = ma+ya", is that which is not; that which truly is not but still appears to be. Sanskrit root : ‘ma’, also means ‘to measure’ : "Miyate Anaya iti Maya"; or, “*that which can be measured is Maya*”! This is very interesting... Anything that can be measured, comes under the domain of Maya! Thus Time ‘measured’ is Maya too! In fact, since Physics rests totally on ‘measurement’; entire Physics is nothing but Maya!!!

From Buddhism comes an interesting story related to Maya’s connection with measurement... It could well have come from Bhaskaracharya II, as part of his Lilawati, but apparently it was Buddha who is said to have narrated it : *A man died, leaving behind 17 elephants as part of his wealth. He had three sons, and he ‘willed’ that the first son should get one-half of his wealth, the second one-third and the third, one-ninth. Now the sons were in a dilemma to divide 17 elephants among themselves in the manner their late father wanted! As it happened, the king, was also passing by on his elephant, and he offered to solve the problem. He alighted from his elephant and put it beside the 17 of the dead man’s, making the total number of elephant, 18. So the first son got one-half of the 18 that is nine elephants. The second got one-third of the 18 that is six. The third got two, one-ninth of the 18 elephants. This left one elephant, the one that the king had added to their father’s collection. He took back the 18<sup>th</sup> elephant, which was nothing but Maya!* Was the division in accordance with the dead man’s will? It

was not. It was a mere illusion that the provisions of the will had been kept. Such is the nature of Maya!

The concept of Maya came into lime light when Jagat Guru Adi Shankaracharya referred to the “*illusory nature of the world*”; ब्रह्म सत्यं जगत् मिथ्या, (*Brahman Satyam Jagat Mithya*), he said; meaning Brahman, the creator of the world, (different from Bramha, one of the Trinity, responsible for giving birth to all living beings), is real, Satya, or True; whereas the world itself that He has created, is just an appearance, Mithya.

Mithya does not mean ‘un-real’ or Asatya; world cannot be un-real, or ‘illusion’ either; for, both these situations are not possible! The great Guru referred to the illusive appearance of the world by which the immeasurable Brahman appears as if measured, (known or understood by our limited faculties).

Another example of Mithya is the ocean and waves. Both are Mithya. Why? Both ocean and waves are just water, with different forms. They are dependent on water for existence. Oceans and waves exist; they are not illusory in nature!

We know that the God, being ‘real’, whatever he ‘creates’ has to be ‘real’ too! So the world is also real; it just appears ‘Mithya’ because of Maya... We are also said to be under the influence of Maya; as we are supposed to have forgotten our infinite, godly, nature and think of ourselves as ‘limited’, finite beings!

By the way, God did not create Maya! Maya is said to be His Nature ( Svabhava, Prakriti ) . There is another theory : Maya is the ‘power’ of God and He has created the world and everything in it, using his power, Maya!!!

The concept of Maya is also linked up with the concept of Duality! If there are two sides of a coin, metaphorically speaking there's a Duality : like the duality of good and evil; peace and war; love and hate; up and down; black and white; etc. We live in a world of duality. In philosophy, the world is made up of two basic, opposed, and irreducible principals. Vedic scriptures say that the world operates under the principle of duality, which is one of the fundamental laws of Maya : the world is not as it seems and that the world that one experiences, is misleading! Time, space, creation and the conscious subjective observer are all incredibly real in **duality**. Non-dual states include deep sleep, swoon, coma and death. Dream is incredibly real within the dream. It is NOT an illusion. From the perspective of the non-dual state of deep sleep, there is no time, no space, no creation and no conscious observer!!!

All the people who have lived on the Earth, till hundred years ago say, are now dead. That puts things into a certain perspective, doesn't it? Billions of people are now gone. Where did they go? Did they simply cease to exist after a paltry few years of life and consciousness? Or do they continue to exist in some way, in some place? These all are 'questions of infinite complexity'!

While on the subject, I may quickly introduce the law of **Karma** : Karma is the universal Hindu law of Cause and Effect which holds a person responsible for his or her actions and effects. According to one's good or bad actions, the God rewards or punishes. The word 'Karma' means human action or deed; we are constantly performing karmas whether physically, mentally, or emotionally. Like Maya, there is no escape from Karma!!!

When we look further out into space, we are in effect looking into the past. Is this not Maya?

Any way; no discussion on Maya would be complete without the Story of Narada, the celestial sage, fetching water for Lord Vishnu... Sage Narada, known ardent devotee of Vishnu, Narayana, had been pestering the Lord, to explain to him, His Maya. Vishnu was avoiding the discussion, making all sorts of excuses. *Maya cannot be explained*, He said, *it has to be seen!* Narad desired to 'see'. So the Lord had to agree. *Come with me if you want to see Maya*, he told Narada. They walked together for quite a distance. Eventually Vishnu said : *Narada, I am feeling very thirsty. Can you fetch me some water while I sit under this tree?* *No problem Lord*, said Narada and walked ahead leaving Vishnu behind, under the tree. He traveled to a nearby village and knocked at the first door that he came across!

The door was opened by an extremely beautiful young girl. At the sight of the girl Narada forgot all about the water and began talking to her. That talk ripened into love; he asked the girl's father for her hand; they were married, lived there for twelve years during which they had three children. In the mean while his father-in-law died and Narada inherited all his land by the side of the river. He ploughed the fields and lived, as he seemed to think, a very happy life with his wife and children, his fields and his cattle, and so forth.

Then came a flood... One night the river rose until it overflowed its banks and flooded the whole village. Houses fell, men and animals were swept away and drowned and everything was floating in the rush of the stream. Narada had to escape. With one hand he held his wife, and with the other, two of his children; another child was on his shoulders and he was trying to forge through this tremendous flood. After some time, the child on his shoulders fell and was swept away by the current of the water. In trying to save that child, Narada lost his grasp of the other two children who were also lost. At last his wife was also torn away from his tight clasp and Narada was thrown on the bank, weeping and wailing in bitter lamentation.

“*Narayana*”, “*Narayana*”, he shouted in total desperation, just as a gentle voice entered his ears, “*Where is the water my child?*” Vishnu was asking; “*You had gone to fetch some water for me, and here I am; waiting for you for more than half-an-hour...*” “*Half-an-hour?*” Narada exclaimed! Twelve whole years seemed to have passed through in his mind; but in fact all these scenes had happened in half-an-hour only, as if in a dream! So this was Maya!!!

Eastern mystics have always preached : Live in the present moment... At any moment, we have nothing more than one moment. When this moment passes, or, when we pass this moment, only then we get the next moment. So, we have just one moment at a time! “*Live here and now*”, they tell us... Whatever you experience, outside this ‘Now’, is nothing but dream, or, ‘dream like’ - Maya! So is the concept of possible “Time Travel”, so popular in the West!!!

The West/science, on the other hand, had so far taught that ‘matter’ is the only reality. Atom is indestructible! But Quantum physics has now shown that the atom can be broken and once that is accomplished, matter is ‘lost’! It turns out to be totally unreal, uncertain! In the same way, ‘Now’, the present moment that we always have, is comparable to the atom of time! So, this ‘Now’ is, in a way, the ‘door’ to time! We transcend it; time ‘disappears’ and we become free from it, the Maya, for; Time (or the time ‘measured’), is nothing but Maya!!!

There is another story from **Ashtavakra Geeta** : King Janak saw a dream... He was a beggar begging for food from houses all around. Finally, he managed to get some food, but just as he was about to eat, a big bull suddenly appeared out of the blue and gave him a big thud. The food fell down and the bull ran away trampling upon it and ruining the whole lot. The King literally dying of hunger, shouted like hell! He woke up in the same state, hungry and sweating all over, wondering whether he was the King or that beggar, he saw in the dream!

He put the same question to all his courtiers, next morning. No one could give him any satisfactory answer.

Later when sage **Ashtavakra** came, King Janak put the same question to him too. Ashtavakra replied : O King, neither this is true, nor that was true. Just as the beggar disappeared the moment you woke up from your sleep, in the same way this King will also disappear, the moment you pick up knowledge of the Self! So, enjoy what you call ‘mine’, but remember that everything is momentary!

There is a similar story in Zen Buddhism, about the Chinese philosopher Zhuang Tzu seeing himself turning into a butterfly in a dream!!!

So, its Maya all over... As I noted earlier, we just don't seem to be able to get out of Maya!

And, what is not Maya? Obviously that which cannot be measured... Joy cannot be measured, love cannot be measured; life cannot be measured... All these do not come under Maya... Truth cannot be measured. Truth, Consciousness, and Bliss – this is what God is... सत्-चित्-आनंद!!!

Going back to the poem, the child's repeated questioning, what will happen after that, *the fundamental question of infinite complexity* with no final answer, is also an act in Maya : trying to ‘limit’ the ‘unlimited’! It may also be referred under the concept of Causality : while talking about it, we had noted that the God is called “The First Cause”! According to the Veda the God is supposed to have said to Himself : एकोहं बहुस्यामः (Ekoham Bahusyamah), meaning “I am one; Let me be Many”; thereby turning Himself into the many fold world! Or Multiverse!!! Did He utilize His Maya in this Leela? Only He would know!!!